

Serial No. 10/034,054

Attorney Docket No. PCI-784

**Claims:**

1. (currently amended) A pump comprising:  
an ~~actuator~~ piston formed of a magnetostrictive material  
susceptible to changes in physical dimensions in the presence  
of a magnetic field;  
first and second pumping chambers coupled to said  
magnetostrictive element to vary in volume as said  
magnetostrictive element changes shape.
2. (original) The pump of claim 1, wherein said first and second  
pumping chambers are driven by opposite ends of said  
magnetostrictive element, to change volume in phase with each  
other.
3. (original) The pump of claim 2, wherein said magnetostrictive  
element has a lengthwise extent, and said first and second  
pumping chambers are driven by opposite ends of said element  
at opposite ends of said lengthwise extent.
4. (original) The pump of claim 3, wherein said pumping first and  
second chambers are located at opposing ends of said  
lengthwise extent.
5. (original) The pump of claim 1, wherein said first and second  
pumping chambers are driven by said magnetostrictive element  
to change volume in opposing phase with each other, so that  
one chamber has a maximum volume as the other has a minimum  
volume.
6. (original) The pump of claim 5, further comprising a third  
pumping chamber, driven by said magnetostrictive element to

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pump in phase with one of said first and second pumping chambers.

7. (original) A pump comprising:

a housing defining a cylindrical cavity;  
a cylindrical actuator formed of magnetostrictive material,  
within said housing and coaxial therewith;  
first and second pumping chambers within said housing at  
opposite ends of a lengthwise extent of said magnetostrictive  
element, each of said pumping chambers mechanically coupled to  
said actuator, to compress as said actuator extends in length.

ai 8. (original) The pump of claim 7, wherein fluid in each of said  
first and second pumping chambers is displaced by a lengthwise  
extension of said actuator.

9. (original) The pump of claim 8, further comprising a third  
chamber extending axially along a length of said actuator,  
fluid in said third chamber displaced by a radial expansion of  
said actuator.

10. (original) The pump of claim 9, wherein inlets of said  
first, second, and third pumping chambers are fluidly coupled.

11. (original) The pump of claim 10, wherein outlets of said  
first, second, and third pumping chambers are fluidly coupled.

12. (original) A pumping assembly, comprising a plurality of  
pumps in accordance with claim 1, wherein inputs and outputs  
of said plurality of pumps are interconnected in parallel.

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13. (original) The pumping assembly of claim 12, wherein each of said plurality of pumps is driven out of phase with each other one of said plurality of pumps.

14. (original) The pumping assembly of claim 13, comprising three pumps.

15. (original) A pumping assembly, comprising a plurality of pumps in accordance with claim 1, wherein inputs and outputs of said plurality of pumps are interconnected in series.

16. (original) A method of pumping fluid using a magnetostrictive element comprising:

ai applying a magnetic field to a magnetostrictive element to cause lengthwise extension of said element at two opposing ends;

driving a first pumping chamber through said extension of a first end of said two opposing ends;

driving a second pumping chamber through said extension of a second of said two opposing ends, opposite said first end, wherein said first pumping chamber is driven in phase with said second pumping chamber.

17. (original) The method of claim 16, further comprising allowing said magnetostrictive element to contract lengthwise, and extend widthwise;  
driving a third pumping chamber with said widthwise expansion of said magnetostrictive element.

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